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Canada Centre for Mineral and Energy Technology
Centre canadien de la technologie des minéraux et de l'énergie

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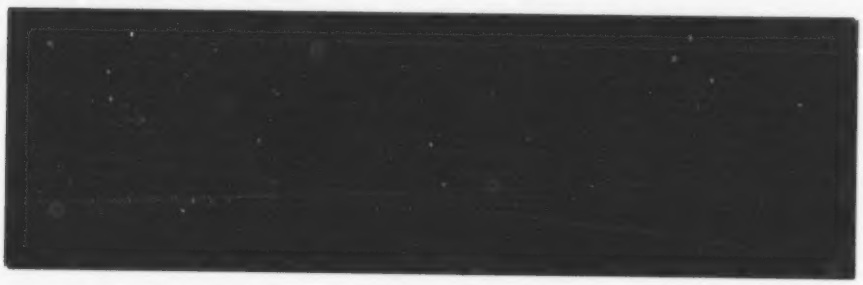

Canada

DEVELOPMENT OF A MINE OPERATIONS DECISION SUPPORT SYSTEM

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DEVELOPMENT OF A MINE OPERATIONS DECISION SUPPORT SYSTEM

by

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EXECUTIVE SUMMARY

Denison has recognized the need for better information technology within its mining operations. CANMET and NRC are willing to participate with Denison in developing tools tailored to Denison needs, while maintaining sufficient generality for use by other operations with minimal modifications. Over the past four months, after a visit to Denison Mines Elliot Lake operations in early April, NRC and CANMET have held many meetings to define how to address Denison needs. A modular approach to developing needed tools has been recognized, as well as time constraints. The final product will be a 'Mine Operation Decision Support System' or MODSS in short. Over the period, communications with Denison personnel have been maintained and, if the project materializes, continued close cooperation will be maintained.

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MISE EN OEUVRE D'UN SYSTÈME DÉCISIONNEL DE SOUTIEN À UNE OPÉRATION MINIÈRE

par

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RÉSUMÉ DE LA DIRECTION

Denison a identifié un besoin accru de technologie informative dans ses opérations souterraines. CANMET et le CNRC sont d'accord pour contribuer avec Denison à la mise en oeuvre d'outils informatiques ajustés aux besoins de la société minière, tout en maintenant un caractère général à ces progiciels de façon à les adapter à d'autres opérations avec un minimum de modifications. Au cours des quatre derniers mois, après une visite aux opérations d'Elliot Lake de la société Denison dans la première semaine d'avril, le CNRC et CANMET se sont réunis à plusieurs reprises, afin de bien définir les besoins de Denison et la meilleure façon d'y répondre. Une approche modulaire à la création des outils nécessaires à cette fin fut retenue, et les contraintes de temps prises en considération. Le produit fini sera un 'Système décisionnel de soutien aux opérations minières' ou SYDSOM en bref. Tout au long de ce laps de temps, les communications avec le personnel de Denison ont été fréquentes et, si le projet se matérialise, il faudra maintenir une proche collaboration entre les parties.

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INTRODUCTION

MITEC, NRC and CANMET have been discussing the promotion of mining companies consortia to transfer or develop information technologies in mining. Underground mining is considered a part of the industry where substantial benefits can accrue by using such tools. Considering the production workplaces dispersion, small incremental improvements may lead to substantial gains in safety and productivity. In open pits where communication and dispatch systems have been introduced, gains in productivity of 10% and more have been recorded. Automation of dispatching operations has led to further 5% to 10% improvements. Recognizing the difficulty of maintaining good communications underground, an overall 10% increase in productivity may be possible underground.

DENISON SOFTWARE NEEDS

It is recognized by CANMET and NRC that Denison has been very active in the past introducing computerized tools tailored to local needs and is continuing to introduce new hardware and software to meet changing operational needs. Underground terminals now being installed are the latest step in a coherent scheme. The technical problem that remains to be solved is tool development to permit maximal use of terminals by underground personnel.

Considering limited personnel availability at Denison, combined with recognized skills for developing technical software tools within Federal Government research organizations, it is indeed logical to match needs with expertise. When Denison heard of consortium build-up for addressing mining needs through ITEM, the company proposed software developments tailored to support underground supervisory decision-making processes.

Until now, no other mining company seems to have reached the level of awareness of Denison. CANMET still hopes that ongoing developments at Denison will generate sufficient interest for others to be interested in joining the project. Future developments will certainly require more resources than Denison can afford on its own. The Government agencies are willing to assume some of the cost, but will not be able to justify commitment to a project with limited industrial support.

CANMET/NRC INVESTIGATION

CANMET and NRC visited Denison in early April 1990 to assess Denison's needs. All of the staff met were very positive about a project that may develop into a useful decision-making tool. So much information was transferred to Government personnel that it took a few months to digest it and to define a project that will suit Denison needs and still be easily adaptable to different mine setups.

Four months, instead of the originally planned three, were required to produce a report. There were many internal discussions, telecopies and five formal meetings between CANMET and NRC to properly define a project with a reasonable chance of successful completion. It is often better to lower expectations at the beginning in order to achieve something, rather than to promise an unattainable goal.

With this in mind, CANMET and NRC propose to develop the project in phases, with a far-reaching goal of developing continued dispatching of men and materials for both operations and maintenance. It is evident that present communication limitations prevent implementation of that ideal situation. It is possible, in the meantime, however, to achieve more reasonable intermediate steps and hope that underground communications will develop rapidly – thereby permitting accelerated advances.

The intermediate steps proposed are:

1. Initiate an Underground Message Center (UMC) where information could be funnelled and computerized. Some software is needed to permit the person receiving calls to easily record information in a very limited time. Also, Shifters' reports could be computerized, to ease cross-shift information flow.

2. Develop means for maintenance and operation supervisors to reconcile engineered production figures with unexpected events in the mine, while ensuring that projected grade and volumes are met in each monthly period. An expert system of some kind should be developed, based on the knowledge of supervision and other personnel.

3. A third step would involve starting shift line-up assistance to shifters and area foremen. Having rapidly accessible data on previous shift results and monthly objectives, equipment status and manpower available, it is possible to build, with supervisor assistance, a best decision model. This could also be developed as an interactive software module, for shifters to arrive at the best allocation of men and materials.

4. A final development would involve an underground continuous dispatch system that would record events as these occur and propose near optimal remedial actions. With the present state of underground communications, this last development cannot result in significant productivity or safety gains. Everybody hopes that, in the coming decade, a more satisfactory communications technology will develop.

Steps involved for each phase of the project include:

1. Identification of end-users.
2. Knowledge acquisition.
3. Identification of suitable software technology.
4. Design, develop and test prototype.
5. Minesite prototype testing.
6. Minesite final software implementation.

Each major intermediate phase requires project review by appropriate mine personnel and other participants involved.

CONCLUSION

A good starting point to developing part of the needed software is to create modules that will simulate the underground operations at Denison in a particular area of the mine. A module could be used to reconcile conveyor data and find the best means of satisfying mill requirements for quantities and quality. Other modules could simulate: truck production; muck removal from faces; scaling and rockbolting; drilling activities. These independant modules represent Phase I of the project and could be used by Denison personnel to analyse various hypotheses and achieve the best shift output with available equipment and personnel. Further phases will integrate these modules and develop from Denison expertise decision criteria to maximise production.

Total Phase I cost to Denison will be $50,000. Total Phase I cost to Government agencies is in the $250,000 range. The Government is willing to assume such a large share of the cost to reach a point where other mining operations should become interested and participate in further development costs.

CANMET and NRC look forward to a fruitful association with Denison.